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INFORMATION CONCERNING RAT SURVEYS AND RAT-PROOFING.

WITH A MODEL ORDINANCE DESIGNED TO REGULATE BUILDING WITH REFERENCE TO RAT-PROOFING.

At a special conference of State and Territorial health officers with the United States Public Health Service, held at Galveston and Beaumont, Tex., August 3 and 4, 1920, the following resolutions were adopted:

Resolved, By this Special Conference of Federal, State, and Municipal Health Authorities on the bubonic plague situation, that a nation-wide effort should be made at the present time to determine as accurately as possible the presence or absence of rodent plague in all ports of entry and principal centers of railway freight transportation in the United States; and be it further

Resolved, That in order that such investigative work and the concomitant preventive measures against the spread of rodent plague shall be carried out in a concertedly effective manner, that the Surgeon General of the United States Public Health Service be requested to send out to all State governments suggestions as to the most efficient eliminative method of carrying on rat surveys and the most practical manner of permanent plague prevention; and be it further

Resolved, That the present serious, even though not alarming, bubonic plague situation in the Southern States should be the occasion for inaugurating a nation-wide campaign against rodents on economic as well as public health grounds.

In accordance with these resolutions the following information is submitted.

The sanitary menace of and the economic loss due to rats are well shown by Creel,[1] and the following is taken from his article on "The Rat":

"Of all the parasites that have their being in and around the habitation of man, the rat has less to justify its existence than any other. As devoid of any redeeming traits as the fly, which has been the subject of a nation-wide sanitary crusade, the rat is a greater pest because of its depredations and its possibilities for harm in the transmission and perpetuation of bubonic plague in a community. The latter consideration is of more serious import in seaport towns wherever they may be and in those localities where plague has once appeared, but with the world-wide march of bubonic plague, in no city should its advent be considered as improbable.

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[1] Creel, R. H., Assistant Surgeon General, United States Public Health Service, The Rat—A Sanitary Menace and an Economic Burden: Reprint No. 135, from the Public Health Reports, Vol. XXVIII, No. 27, July 4, 1913.

"Squirrels to the westward of the Rocky Mountains and the marmot in Asia are subject to the disease in a more or less chronic form; but these animals, on account of their infrequent contact with man, are a menace not so much in transmitting the disease to man as they are in being the source of a continued reintroduction of the disease among the neighboring rat population. It is, therefore, evident that the slogan 'No rats, no plague' is very expressive of fact.

"A brief review of the rôle this animal plays in transmitting disease and in damaging and destroying property will easily convict it of being a most undesirable denizen.

"No discussion of the part taken by the rat in spreading plague will be attempted, except to say that plague is primarily and essentially a disease of rodents, chiefly the different species of rat, and that it is conveyed to human beings from plague-infected rats through the agency of the fleas which infest the sick animal.

"When plague has once gained a foothold in a country, the cost of stamping out the infection will be manifold the expense attendant upon the eradication of any other epidemic disease. The toll of human life may vary according to local conditions, but always the commercial prejudice against a plague-infected port and the expenditure for eliminative measures will result in heavy financial drain.

"Turning from the aspect of a sanitary menace to an ever-present and continued commercial drain, the following is of interest: To assign any accurately fixed sum to the amount of injury done by rats in the United States is impossible, but, estimating the loss at a rational minimum amount, the sum is astounding. The calculation embraces two factors, namely, the rodent census and the average amount of damage done by one rat. Both of these factors can be determined within reasonable limitation.

"For antiplague work in the United States and its insular possessions, the Philippines, Hawaii, and Porto Rico, there has been spent in recent years by the Federal Government, through the United States Public Health Service, and by the different local government forces, a vast sum. The loss to commercial interests in all these places, due to interference with shipping facilities and sanitary restrictions by other countries, has made the sum actually spent for plague work seem but a 'drop in the bucket.'

"The scope of this article will not permit of an extended discussion of the sanitary aspect of plague, but it may be stated that the disease is endemic on every continent in the world and in practically all countries, excepting, possibly, those of continental Europe. In our own country any laxity of sanitary surveillance of the endemic centers on the Pacific coast would result in the broadcast spread of the disease. The same will apply to all endemic centers. It is a question of eternal vigilance.

"By means of trapping percentages covering a period of one year it was determined that the rodent population in San Francisco was slightly in excess of the human population. In Porto Rico, where the same method of computation was employed, the proportion of rat and human inhabitants in cities was about equal.

"In the rural districts of the United States the number of rats on any farm or plantation will easily average three or four times the number of people on the estate, and in the grain or cane producing areas the proportion will be multifold.

"In cane-producing tropical and semitropical countries, such as Porto Rico, all the West Indies, the Hawaiian Islands, and the Philippines, where the roof rat and field rat predominate, the rat population is incredibly large. On one cane plantation in Porto Rico where there were less than 500 people, within six months there were killed 25,000 rodents.

"It is therefore evident that an estimate of the rodent population of the United States as equal to the human census would be well below the probable number. In our insular dependencies—Porto Rico, Hawaii, and the Philippines—where the cane fields are especially overrun with rats, the rodent population is undoubtedly several times the human population.

"This estimate of one rat per human being for the continental United States coincides with that made for Great Britain and Ireland by the Incorporated Society for the Destruction of Vermin, and also with authoritative figures for Denmark, France, and Germany.

"The annual upkeep per rodent was computed by the same authorities as $1.80 in Great Britain, $1.20 in Denmark, and $1 in France. Judging from the large number of complaints made by American farmers in writing to agricultural journals, the depredations of rats in the country will exceed the estimate made in Great Britain. One-half cent per day would be a conservative estimate, however. The same figure can safely be placed on the damage caused by the city rat.

"The list of articles damaged by rats is too long to enumerate in detail, but in general the following can be mentioned: All kinds of grain, before and after harvest; eggs and poultry, especially small chicks; wild birds, their eggs and young; fruits and vegetables, both while growing and when stored; flowers, bulbs, and shrubbery; all kinds of staples in bags or boxes; and all food products in pantries, groceries, meat markets, bakeries, stables, and general markets.

"Lantz, in the Public Health Bulletin No. 30, 'The Rat and its Relation to Public Health,' cites the following specific cases of rat depredation. Presumably they were selected at random:

" 'An Iowa farmer writing to an agricultural journal reported that rats had destroyed in one winter about 500 bushels of corn of a total of 2,000 bushels stored in cribs. Another farmer reported that rats had robbed him of an entire summer's hatching of three or four hundred chicks, and still another one attributed his loss in grain and poultry for one season due to rats as sufficient to pay his taxes for three years.'

"Lantz further quotes a Washington merchant to the effect that rats gnawed a hole in a tub containing 100 dozen eggs and within a period of two weeks carried away 71 dozen without leaving either shell or stain.

"The writer once observed in San Francisco a shop dedicated to the sale of manicure supplies that was so rat infested that the proprietor had to move. The shop adjoined a bakery, and the depredations of the rats were so great that they actually entered a glass display case and gnawed the chamois skin on nail polishers. The reports of experimental stations in Guam, Hawaii, and Porto Rico lay special stress on the depredations of rats in the cane fields. Mr. R. L. Van Dine, of the Porto Rico experimental station, places the annual loss to cane growers in the island at $75,000, and states the loss is due not only to the cane actually destroyed, but also to the fermentation set up in the cane juices in the stalks that have been gnawed upon, which reduces the purity and sucrose content. This loss to Porto Rico planters was based upon the estimate that only one-half of 1 per cent of stalks were attacked by rats, but in reply to inquiries sent out by Van Dine the estimate made by different planters varied from 1 to 4 per cent of stalks attacked by rodents.

"Because the rat is an animal of nocturnal habits, its depredations often pass unnoticed or are ascribed to other sources. Computing the upkeep of the rat as one-half cent per day, and estimating one rat to each person, the sum of $167,000,000 annually is lost to the country by the depredations of this pest.

"A ratless country seems almost Utopian, but much can be accomplished in preventing this unnecessary loss and in safeguarding the country from any possible plague invasion, by a concerted and well-sustained nation-wide crusade against the rat similar to the 'swat the fly campaign.' No sporadic or individual effort will suffice.

"The extermination of rats is not nearly so easy as fly destruction. An adult rat will, on an average, produce young 6 times yearly and from 6 to 12 young in each litter. There have been known cases where a full-grown female littered 12 times in one year. A rat can reproduce when 3 months old. This remarkable fecundity, together with the instinctive secretive habits of the rat, which, being an animal of nocturnal habits, lies hidden during the day, and is active at night while his human foe is asleep, readily accounts for the large rat population in any locality and emphasizes the difficulty of rat destruction.

"Rats can be destroyed by trapping, by poisoning, and by using natural enemies, as certain breeds of cats and dogs. To insure success to these measures it will be necessary to curtail the rat's food supply by properly disposing of garbage and table refuse and by preventing rats from gaining access to such food as is contained in pantries, groceries, markets, stables, etc. The municipal government will have to assist the efforts of citizens along this line by creating and enforcing suitable rat-proofing laws.

"To merely keep premises clean and free of rubbish will be of but little benefit, as rodents generally, even when abundant rubbish is available, prefer more secure covert, as that beneath floors, and within double walls and ceilings. So, along with other measures for the destruction of rats, all buildings, chicken yards, garbage receptacles, sidewalks, and planked areas must be built or repaired to prevent rat harborage."

Institution of Rat Surveys.[1]

With bubonic plague, both human and rodent, actually known to be present in several parts of the United States, it would seem to be both wise and expedient for cities and towns throughout the country to determine the disease status of their rat population.

By means of a carefully conducted rat survey it is possible to know with a fair degree of certainty whether or not rodent plague has been introduced. It is reasonable to believe that plague always exists among rats for some time before the infection is transmitted to human beings. It follows quite logically that if the presence of plague among rats be ascertained early during this interval, prompt and active control measures may interrupt the passage to the human subject. The value of such "health insurance" can not be denied.

Economically, a rat survey, with the consequent killing of a large number of rats, is decidedly a good investment. Conducted with due regard for the cost of operation, a survey will pay for itself in actual saving of food products and in preventing destruction of stored goods and fixtures.

Before instituting a rat survey, certain principles should be clearly understood. The primary object of the survey is to secure well-preserved specimens for laboratory examination. To afford data of determinative significance, specimens must be taken generally from all parts of a community, and in sufficient numbers to represent the rat population of any given section.

Observers agree that there is at least one rat per capita of human population in urban communities. These animals are not to be found uniformly distributed throughout a community, but, because of location and accessibility of food supplies and favorable hiding and harboring places, they concentrate themselves in selected areas.

In order to define centers of rat infestation, a preliminary survey should be undertaken. Only in this manner can the useless expense of trapping sterile areas be avoided. The information gained from this study will permit an accurate estimate of the number of trappers needed, and of the quantity of traps and other equipment required to secure a predetermined number of rodents.

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[1] Prepared by Passed Asst. Surg. C. V. Akin, United States Public Health Service.

As an arbitrary standard of trapping, it has been suggested that 10 per cent of the estimated rat population be fixed as the number to be examined. The examination of 1,000 rats per 10,000 human population will afford reliable evidence of the occurrence of plague.

The major requirements for the conduct of a rat survey divide themselves into seven sections. These are essential. They are not analyzed here in the order of their relative importance.

1. *Supervision.*—The success of the rat survey, both hygienic and economic, depends upon the careful, personal attention given its conduct by the individual in charge. Every detail of administration, the preliminary survey, the selection and purchase of equipment, the employment of trappers, and the collection and examination of specimens should have the attention of some one responsible person. The community health officer is the person of choice for this important duty.

2. *Estimate of needs and expenditures.*—The expenses of a rat survey will be determined largely by the number of specimens to be taken and by the existing resources of the community for handling the specimens. Factors to be considered are: area to be covered in trapping operations; period of time to be devoted to the campaign; and number of trappers to be used to produce results in the time given.

The cost of capturing and examining a rat has been variously estimated at from 38 cents to $2. The first figure is considerably lower and the latter about 100 per cent higher than the average.

Certain tentative fundamental figures are suggested:

(*a*) From two to four trappers will be required to cover each square mile of territory. The size of the trapping district assigned each man will vary with the type of habitation.

(*b*) Each trapper should have a base supply of 100 snap traps and a reserve of 100.

(*c*) The salary of trappers will vary with the locality, but should not exceed $75 per month.

(*d*) A bounty should be offered to stimulate trapping. A general bounty of 10 cents per rat, dead or alive, should be sufficient.

(*e*) The total cost of a trapper's equipment, including 200 traps, should not exceed $40.

(*f*) The cost of transportation varies.

3. *Equipment.*—With the possible exception of traps, all essential equipment can be purchased locally.

Each trapper should be provided with the following articles: Two hundred snap traps; one 12-quart galvanized bucket with tight cover;

one 6-inch side-cutting plier; one 2-cell flash light; one brush (paint) for oiling traps; one brush (wire bristle) for cleaning traps; one triangular file; cord for securing traps; string for affixing identification tags to specimens; and tags.

4. *Transportation.*—Motor transportation is necessary to save time in two important operations: first, in distributing trappers in the early morning; and second, in collecting the catch and taking it to the laboratory. One small touring car will serve the purpose and also be of use in maintaining supervision.

5. *Trapping of specimens.*—For survey purposes no other method than trapping need be considered for securing specimens fit for laboratory examination.

Success in trapping depends entirely upon the careful, intelligent handling, baiting, and placing of traps. A trapper must study the habits and appetites of the animal he plans to capture.

The major portion of each day should be spent in preparing and cleaning traps and in locating promising rat runs and hiding places. The afternoon hours are best devoted to this work, as the best catches are made at night.

6. *Collection of specimens.*—No time should be lost between the trapping of rats and their delivery to the laboratory. Putrid specimens are of doubtful value. The trapper should be required to collect his catch early in the morning, working his district in such a manner that he will arrive with his catch at a fixed point at a designated time. Operating on a fixed schedule, an automobile should be driven from point to point, collecting the various catches, which are placed in a large metal can partly filled with a pulicide. The alternative to this method is for trappers to deliver catches to a central station, where they are dipped in pulicide before being taken to the laboratory. Kerosene is an excellent pulicide.

Trapping hours and hours of collection must be arranged to meet local conditions, but the various operations must be timed in sequence so that cooperation between field force and laboratory is perfect.

7. *Laboratory.*—Any laboratory affording from 250 to 300 square feet of floor space in a well-lighted and well-ventilated room will provide quarters for handling 300 specimens in a single catch.

The examination of rats for plague resolves itself into two parts: the recording and autopsying, to be undertaken by assistants, and the bacteriological tests, to be performed only by a skilled technician.

Careful numerical records should be kept of all rats handled, and exact data should be kept concerning the condition of specimens.

The technique of examination and the precautions to be observed are discussed in special publications of the Public Health Service.

Special points.—For a rat survey to be of value, the data collected must be as nearly correct as painstaking care will insure.

If rodent plague is present in a community, it is essential to know not only that it is present, but also the exact location from which the infected animal was taken. For this reason too much care can not be exercised in the preparation of identifying tags that are to be affixed to the rat when it is taken from the trap. The interest of the trapper may be kept alive on this point if a bounty of $5 or more be offered for each properly identified plague-infected rat.

The selection of bait involves questions both of cost and efficacy. Baker's bread (white) meets all requirements, being attractive to both rats and mice, easily obtainable, and less expensive than other baits.

Unless large catches are made during daylight hours, only one delivery a day need be made to the laboratory. All traps must be emptied every morning to prevent the nuisance of decomposing rats.

The development of a rat survey should be made the occasion of popularizing rat eradicative measures among the general population. This general activity should be separate and distinct from the organized effort of the community authorities.

Rat Proofing.

The rat-proofing of buildings is generally secured either by elevation of the structure, with the underpinning open and free, or by marginal rat-proof walls of concrete or of stone or brick laid in cement mortar, sunk 2 feet into the ground, and fitting flush to the floor above. The wall must fit tightly to the flooring and not merely extend to the joists or supporting timbers, as this would result in open spaces, permitting the entrance of rodents. Groceries, stables, warehouses, markets, and food depots in general are best rat-proofed by having a concrete floor in addition to concrete walls. In these structures, untenanted as they are at night, rats might well enter by a doorway or window carelessly left open, or be introduced concealed in merchandise, and, gnawing through plank flooring, obtain a well-protected hiding and breeding place.

In addition to concrete floor and walls, these food depots must have tight-fitting doors, and all windows and other openings should be properly screened. A 12-gauge wire is preferable on account of its strength and durability, and the mesh should not be larger than one-half inch.

Rat-proofing by elevation of the building is chiefly applicable to small and medium-sized frame dwellings. The purpose is to have a sufficient elevation, about 2 feet, so that the ground area beneath will be as exposed and free from covert as land unbuilt upon. Marginal rat-proofing will suffice in more pretentious dwellings where sufficient care can be exercised to prevent rats from gnawing through the plank floors.

Chicken pens can be protected by marginal concrete walls, sunk into the ground 2 feet or more, and by covering the sides and top with ½-inch mesh wire netting. Garbage cans should be made of serviceable metal and should have properly fitting tops.

Plank sidewalks and plank coverings for yards should be avoided. Cinders or concrete should be used instead. The latter should have marginal protection to prevent rats from burrowing beneath it.

Double walls, with a dead space between, should be avoided, or, if used, they should be rat-proofed at the top and bottom with heavy wooden timbers, 4 by 4 inch fillers, or by a concrete fill. Attics should be well opened and kept free of rubbish or other refuge for rats.

These precautions against rat harborage and for the protection of food supplies, in connection with careful trapping and poisoning, will be attended with considerable success in the destruction of rats.

The appended model ordinance is applicable, with perhaps slight modifications, to any urban community. It should be examined by competent local counsel for changes in form, or in substance if necessary, as dictated by special constitutional, legislative, or charter considerations.

Model Building Ordinance.

ORDINANCE NO. —.

An ordinance requiring every building, house, outhouse, or other superstructure hereinafter to be erected in the city of ——— to be rat-proofed.

Be it ordained by the city council of ———.

SECTION 1. That every building, house, outhouse, or other superstructure of any and every character whatsoever hereafter erected in the city of ——— shall be rat-proofed in the manner hereinafter provided.

SEC. 2. It shall be unlawful for any person to construct any building, house, outhouse, or other superstructure within the corporate limits of the city of ——— unless the same shall be rat-proofed as hereinafter provided.

SEC. 3. For the purpose of rat-proofing, all buildings, houses, outhouses, or other superstructures, except stables, shall be divided into two classes, to wit: Class A and Class B.

SEC. 4. That every restaurant and restaurant kitchen, hotel and hotel kitchen, boarding-house kitchen, slaughterhouse, packing house, bakery, every place where foodstuffs or refreshments of either solid or liquid form are manufactured, stored, kept, sold, prepared, or offered for sale, every warehouse, freight shed; every place wherein live or dressed poultry, game, animals, or birds are sold, stored, or kept for sale; every junk shop, chicken, or poultry house, pen or inclosure, and every place where hides are kept, handled or stored, shall be rat-proofed in the manner provided for hereinafter as Class A.

All other buildings, outhouses, and superstructures, except stables, not hereinbefore specified as Class A, and all buildings used exclusively for residential purposes, shall be rat-proofed in the manner provided for hereinafter as Class B; provided that the owner of any building, residence, outhouse, or other superstructure in Class B, may, if he so elects, rat-proof the same in the manner provided for in Class A.

"Foodstuffs," as used in this ordinance, is hereby defined to mean flour, flour products, animals and animal products, produce, groceries, cereals, grain and the products of cereals and grain, poultry and its products, game, birds, fish, vegetables, fruits, milk, cream, and the products from milk or cream, ice cream, liquid refreshments of every character, or any combination of any one or more of the foregoing.

SEC. 5. That the construction and material used in rat-proofing shall conform to the building ordinances of the city of ———, except, and only in so far, as the same be modified herein.

SEC. 6. *Class A.* The ground floor of every building, outhouse or other superstructure in Class A shall be of concrete, which concrete shall be not less than three inches thick and overlaid with a top dressing of cement, mosaic, tiling, or other material impermeable to rats, and such floor shall rest, without any intervening space between, upon the ground; said floor shall extend, and be hermetically sealed to, walls surrounding said floor, which walls shall be of concrete, or of stone or brick laid in cement mortar, and each wall to be not less than six inches thick, and shall extend into and below the surface of the surrounding ground not less than two (2) feet, and shall extend upwards not less than twelve (12) inches above the surface of said floor.

SEC. 7. *Class B.* All buildings, outhouses, and other superstructures of Class B, shall be set upon pillars or underpinnings of concrete, or of stone or brick laid in cement mortar, such pillars or underpinnings to be not less than eighteen (18) inches high, except where the building, outhouse, or superstructure is more than thirty (30) feet in width, the height to be measured from the ground level to the top of said pillars or underpinnings, and the intervening space between the building and the ground level to be open on at least three sides and to be free from all rubbish and other rat-harboring material, or may be rat-proofed by constructing at the margin of the ground area of said building a sustaining wall of concrete, or of brick or stone laid in cement mortar, such wall to extend into and below the surface of the ground at least two (2) feet and to meet the floor of the building above closely without any intervening space. Such walls shall be at least six (6) inches thick and shall extend entirely around the said building: *Provided*, That said walls may be built with openings therein for ventilation only: *And provided further*, That such openings for ventilation may be of such size as the owner may elect and shall be securely screened with metallic gratings having openings between the bars of said gratings of not more than one-half (½) inch, or with a wire mesh of not less than 12 gauge, having openings between the wires of said mesh of not more than one-half (½) inch and the whole so constructed and closed as to prevent the entrance of rats beneath such buildings.

Provided, That when the owner of any building, outhouse, or other superstructure, which is more than thirty (30) feet in width and which is herein classified as Class B, shall elect to rat-proof same by elevating same, that he shall elevate same to a height in excess of eighteen (18) inches to wit: that for every additional ten (10) feet or fraction thereof in excess of thirty (30) feet in width, the building outhouse, or other superstructure shall be elevated an additional six (6) inches.

SEC. 8. That in any case where, under the provisions of this ordinance, any building, outhouse, or superstructure is required to be rat-proofed as Class A, and the said building or outhouse or superstructure is used in part for residential purposes, and the part used as a residence is effectively separated from the part falling within Class A by permanently and effectively closing all openings above and below the ground floor or by constructing a new wall, and in either case the whole, in such manner as to make such wall wholly and continuously in its entirety without doorways, windows, or other openings between the part used as a residence and that used for such purpose as makes it fall within Class A, then in such case, and for rat-proofing purposes only, the said building will, after such separation and closure of the openings, or by the construction of such new wall, be deemed to be two buildings, and that the part used exclusively for residential purposes may be rat-proofed in the manner provided for as a Class B building, and the remaining part of said building shall be rat-proofed in the manner provided for as Class A buildings.

SEC. 9. *Stables.*—Every building hereafter constructed and used for stabling any horse, cow, mule, or any other animal or animals shall be constructed as in this section provided.

Walls.—The sustaining walls of such building shall be constructed of concrete, or of brick or stone laid in cement mortar, and shall be not less than six (6) inches thick and shall extend into and below the surface of the surrounding ground not less than two (2) feet, and shall extend above the ground a sufficient height to be not less than one (1) foot above the floor level. All openings in such foundation wall shall be covered with metal grating having openings not greater than one-half (½) inch between the gratings.

Floors.—The floors of stables and stalls shall be of concrete, not less than three (3) inches thick, upon which shall be laid a dressing not less than one-half (½) inch thick, of cement, or of stone laid in cement mortar in such way as to prevent ingress or egress of rats, and such floors to have a slope of one-eighth (⅛) inch per foot to the gutter drains hereinafter provided for.

It shall be unlawful to install or construct or permit to be installed or constructed any double wall, double floor, or double ceiling with open spaces therein in any building or superstructure used or intended to be used as a stable.

Stalls.—Floors of stalls may be of planking, fitting together tightly to the concrete floor, or elevated not more than one-half (½) inch from the concrete floor and so constructed as to be easily removed. Such removable planking shall be raised at least once a week and the said planking and the concrete floor beneath thoroughly cleansed.

Gutters.—Semicircular or V-shaped gutter drains shall be constructed in such stables in such manner that the gutter shall be placed so as to receive all liquid matter from each stall and to carry it from said stable.

Manure.—All manure in and about all stables shall be removed therefrom at least once a week, and the same shall be removed entirely from the premises, unless scattered as fertilizer or otherwise utilized, so as not to furnish food for and attract rats.

Mangers.—Each manger shall be constructed so that the sides shall have an inward slope from top to bottom of two (2) inches and, if made of wood, shall be covered with tin or zinc and shall be at least eighteen (18) inches deep to avoid the spilling of food.

Feed bins.—All feed bins shall be constructed of cement, stone, metal, or wood, and with close-fitting doors. If constructed of wood, the bin shall be lined or covered with metal and the whole so constructed as to prevent the ingress or egress of rats.

All grain, malt, and other animal food, except hay, stored or kept in any stable must be kept in such feed bins. Said feed bins must be closed at all times, except when momentarily opened to take feed therefrom, or when the same are being filled. No feed shall be scattered about such bin or stable, and all such feed found on the floor or in a stall of such stable shall be removed daily with the manure. No foodstuffs intended for or susceptible of human consumption shall be kept or stored in any stable or any other place where animals are kept.

SEC. 10. That all accidental and unnecessary spaces and holes, ventilators, and openings other than doors and windows, in every building, outhouse, and other superstructure hereafter erected in the city of ——— shall be closed with cement mortar or other material impervious to rats or screened with wire, having not more than one-half ($\frac{1}{2}$) inch mesh, as the case may require, or be closed with galvanized iron; and all wall spaces shall be closed with cement mortar or other material impervious to rats, which closure shall extend the full thickness of the wall and shall extend upward at least twelve (12) inches above the floor level, and the whole done in such manner as to prevent the ingress or egress of rats: *Provided*, That in all buildings, outhouses, and other superstructures of Class A, and in all stables where there are any spaces in walls between the wall proper and the covering of same, or in ceilings between the ceiling and the floor or other ceiling covering, both said spaces shall be eliminated by the removal of said covering or effectively blocked or closed so as to prevent the ingress or egress of rats.

SEC. 11. That all premises, improved and unimproved, on all open lots, areas, streets, sidewalks, alleys, in the city of ——— shall be kept clean and free from all rubbish, as well as loose material that might serve as harborage for rats; and all lumber, boxes, barrels, and loose iron, as well as material that may be permitted to remain thereon and that may be used as a harborage for rats shall be placed on supports and elevated not less than two (2) feet from the ground, with a clear intervening space beneath to prevent the harboring of rats.

SEC. 12. That all planking and plank walks on and in the yards, alleyways, streets, sidewalks, or other open areas shall be removed and replaced with concrete, or with brick or stone laid in cement or gravel, or the ground left bare: *Provided*, That nothing herein shall apply to streets or other public places paved with wooden blocks.

SEC. 13. It shall be lawful to install a cellar or basement in any building, outhouse, or superstructure hereafter erected in the city of ———, but in every such case the cellar or basement shall be inclosed within solid walls of concrete, or of stone or brick laid in cement mortar, or tiles of not less than nine (9) inches, with no openings below ground save for plumbing, and such openings securely protected against the ingress or egress of rats, and with no openings above ground, except doors and such windows or light or air vents as will be susceptible of being screened with wire screens of not exceeding one-half ($\frac{1}{2}$) inch mesh; and such cellars or basements shall have the floor constructed of concrete or stone at least three (3) inches thick, or of brick laid in cement mortar, and such floor shall be hermetically sealed to the walls of such cellar or basement. The doors or trapdoors for entry to such cellar or basement shall be securely fitted in such manner as to prevent, when closed, the ingress or egress of rats.

SEC. 14. No permit shall be granted by the building inspector (or other official whose duty it is to grant building permits) for the reconstruction, alteration, or repair of any building, outhouse, or other superstructure in the city of ——— unless provisions shall be made in the plans therefor for the proper rat-proofing of such building or superstructure in substantial compliance with the provisions of this ordinance when, in the judgment of the building inspector (or other official whose duty it is to grant building permits) it is practicable, desirable, or necessary that such rat-proofing be done; but in no event shall such reconstruction, alteration, or repair be permitted without full compliance with all the provisions of this ordinance, where the cost and expense of such reconstruction, alteration, or repair shall, in the opinion of the building inspector (or other official whose duty it is to issue building permits) equal or exceed forty (40) per cent of the value of the structure sought to be reconstructed, altered, or repaired.

Sec. 15. That the word person as used in this ordinance shall be taken to mean and include firms, copartnerships, corporations, and persons of both sexes.

Sec. 16. That any ordinance or part of ordinance in conflict with the provisions of this ordinance is hereby repealed to the extent of such conflict.

Sec. 17. Should any part of this ordinance be declared invalid, the remaining portions shall not thereupon be invalidated, but shall remain in full force and effect.

Sec. 18. *Penalty.*—Any person violating any of the provisions of this ordinance shall be punished by fine not to exceed ——— or by imprisonment not to exceed ——— or by such fine and imprisonment.

Sec. 19. *Emergency.*—(The clause declaring an emergency to be inserted if necessary under local laws.)

TYPHOID REDUCTION IN SOUTH CAROLINA.

Comparative Results in Counties With and Without Health Organizations.[1]

By L. A. Riser, M. D., Director County Health Work, South Carolina State Board of Health.

The vital statistics department was organized in South Carolina in 1915, and we have no accurate records of deaths from typhoid previous to that year. In this paper I will attempt to show how typhoid fever has decreased, and what methods are being used to effect this decrease. The decrease has been gradual since 1915, with the exception of 1918, during which year the Army camps brought more than 100,000 people to the State. This does not refer to soldiers, but to workmen and camp followers, who were not under Army restrictions, and we credit to this fact the increase in 1918, as the cities in which these camps were constructed showed very large increases, some of them doubling their number of deaths of the preceding year.

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[1] Read before the Section on Preventive Medicine and Public Health at the Seventy-First Annual Session of the American Medical Association, New Orleans, April, 1920, and published in the Journal of the American Medical Association, June 12, 1920. Reprinted here by permission.